proved that water alone is produced by the combustion of hydrogen" (pp. 157-58).

Although he devotes only two chapters to it, it is obvious that it is the main purpose of Prof. von Meyer's work to trace the development of chemistry from the downfall of phlogistonism onwards, and he has therefore only dealt with the earlier periods in order to give the reader a connected view of the growth of the science. This portion of the work is touched with a comparatively light hand, and in some respects compares unfavourably with the rest. Although at times there are graphic sketches—as, for example, in the account of Palissy's work, and in the estimate of Bergmann's services to analytical chemistry, and in the story of that strange compound of truculent charlatanry, gross mysticism, and strong common-sense, who called himself Philippus Aureolus Paracelsus Theophrastus Bombastus—the general impression is not wholly satisfactory, and to trace the historical connection of the several epochs presupposes more knowledge than Prof. von Meyer imparts. It is hardly possible to do justice to the age of alchemy in 40 pages, or to the history of the iatro-chemical period, which includes the work not only of Paracelsus and his school, but also that of Van Helmont, George Agricola, Palissy, and Glauber, in 30 pages. But with the "Geschichte der Chemie" before him, Prof. von Meyer may well have hesitated to plough with the patient heifer of Hermann Kopp.

In his fourth chapter, where he deals with the period of the phlogiston theory, the author begins to expand somewhat, but occasionally, we venture to think, at the expense of strict historical accuracy. Thus it is not strictly true to say that Kunkel laboured "for years" to discover the secret of the preparation of phosphorus (p. 141), or that Cavendish defended the phlogistic theory "with all his might" (p. 118). That singularly austere and passionless person—that "cold clear Intelligence," as Wilson calls him—was utterly incapable of entering the lists as the champion of any theory. He let his Irish friend Kirwan, to whom it was more congenial, do all the fighting. It is hardly correct to describe the calm and philosophic Priestley as "eccentric and of a restless fiery nature." No man gave and got harder knocks in his time than did the kind-hearted, even-tempered old philosopher; he, too, did his fighting "all in the way of business," hitting straight and above belt, and with no malice in his blow; but to call him "eccentric," or "restless and fiery," reveals an entire misconception of his disposition and character. The occasion of Lavoisier's admission into the French Academy is only partially stated, and it is not wholly true to say that amongst all his numerous friends and admirers only one chemist, Loysel, had the courage to protest against his execution (p. 153).

A word in conclusion as to the manner in which Dr. McGowan has done the work of translation. His aim, he tells us, has been to reproduce clearly the sense of the German original, and in this he has, no doubt, succeeded admirably. But a purist might object that, in his efforts to preserve the sense, he has too carefully retained the idiom. To say that "the absorption of medicine in chemistry, the fusion of both together, was the watchword which emanated from Paracelsus" (p. 3) is scarcely a happy method of expression. Nor is this paragraph much better:—

"Spirit of wine—the *aqua vitæ* of the alchemists—continued to grow in importance during the iatro-chemical age, as it had done in the alchemistic. This applied to it not merely from a theoretical point of view, as being a product of various fermentation processes to which much attention was paid, but also from a practical, since Paracelsus and his disciples used it largely in the preparation of essences and tinctures" (p. 95).

On p. 101, Boyle's manor in Dorsetshire is erroneously called "Stolbridge," and on p. 185 "Dalton" is incorrectly printed for "Davy." Such terms as "centre-point" and "fire-stuff" are not current English. Dr. McGowan's duty as a translator doubtless required him to say that "the nobility and poetry of his [Davy's] nature are shown both in the journals which he kept during his extensive travels in France, Germany, and Italy, and in his beautiful relations to Faraday" (p. 187); but the veracious historian, familiar with the annals of the Royal Institution, would probably have expressed himself differently.

T. E. THORPE.

PROGRESS IN ELEMENTARY BIOLOGY.

Lessons in Elementary Biology. By T. Jeffery Parker, B.Sc., F.R.S., Professor of Biology in the University of Otago, New Zealand. (London: Macmillan and Co., 1891.)

PROF. JEFFERY PARKER is to be congratulated on having produced an extremely well-written, well-considered, and original class-book. The teaching of so-called "elementary biology" has, in consequence of the coercion of examination schedules and the multiplication of little cram-books dealing with the selected and protected "types," become in this country a very poor thing. The practical work in the laboratory with frog, fern, rabbit, and worm, which was, when first introduced, a step in advance, has become, like so many other things which were good in their origin, a tyranny and an impediment to knowledge. Students have resolutely shut their eyes to all facts but those presented by the schedule types, and teachers of a certain class have seen the easiest way to secure "examination results" in ignoring the generalizations of biology, and in plying their pupils with the regulation details as to the few animals and plants scheduled for dissection. Prof. Parker's book should help to remedy this state of things. His aim has been, he states, to supply the connected narrative which would be out of place in a practical hand-book. I agree with him that the main object of teaching biology as part of a liberal education is to familiarize the student not so much with the facts as with the ideas of science. In this little book the student will find many of the most important conceptions of biological science set forth and illustrated, not by reference merely to the types which he dissects or examines with greatest ease in the elementary course in a laboratory, but by the use of a larger area of well-chosen examples, both of plants and animals. Original woodcuts, often of exceptional merit, are freely introduced in the text.

Whilst the plan of Prof. Parker's book is excellent, I cannot help feeling some regret that he has not carried it out on a somewhat larger scale, so as to make his volume represent for the biology of to-day what the classical "Comparative Physiology" of Dr. Carpenter did for the biology of forty years ago. The defect just alluded to—if it be a defect—is one which can very well be remedied hereafter, since the author will undoubtedly have an opportunity of expanding his book in every direction in a later edition.

Nearly half the book is devoted to the consideration of the phenomena of life as exhibited by unicellular organisms—the Protozoa and Protophyta. There can hardly be any doubt that this is by no means an undue proportion, since it is unquestionable that in these simplest forms the fundamental problems of biology present themselves in the clearest light. We have well-illustrated chapters on Amœba, on Hæmatococcus, on Heteromita, on Euglena, on the Mycetozoa, and then a comparison of the foregoing organisms with certain constituent parts of the higher animals and plants, viz. cells. The minute structure and division of cells and nuclei are fully treated and well illustrated. Then follow separate chapters on yeast, on bacteria, on biogenesis and abiogenesis, and on the more complicated unicellular animals—the Ciliata, from among which are chosen Paramœcium, Stylonichia, Oxytricha, Opalina, Vorticella, and Zoothamnium. A chapter on species and their origin, and the principles of classification, comes next, the illustrative examples being chosen from among the Protozoa already described. The Foraminifera, Radiolaria, and the Diatomaceæ are then brought under consideration. In every chapter the organism or group of organisms treated is made to serve as the concrete basis of a gradually expanding and connected narrative. Thus, in passing to the consideration of such forms as Mucor, Vaucheria, and Caulerpa, the author says:—

> "The five preceding lessons have shown us how complex a cell may become, either by internal differentiation of its protoplasm or by differentiation of its cell-wall. In this and the following lessons we shall see how a considerable degree of specialization may be attained by the elongation of cells into filaments."

A pause is now made, and a brief but thoroughly up-to-date chapter is inserted on "the distinctive characters of animals and plants." Prof. Parker thinks there is a great deal to be said in favour of Haeckel's third organic kingdom—the Protista. I do not agree with him in thinking that it is probable that the earliest organisms were "protists," and that from them animals and plants were evolved along divergent lines of descent.

If we approach this question, not with the attempt to define plants and animals verbally, but with the object of indicating probable lines of descent, the groups sometimes considered as doubtful, and therefore "protist," take rank with great probability either in the animal or the vegetable series. The Mycetozoa and the Volvocineæ fit quite naturally in the animal series; they would be isolated among the Protophyta, and, conversely, the Bacteriaceæ are inseparable from the Oscillatoriæ and other filamentous green plants.

Prof. Parker next proceeds to deal with plants of increasing complexity of structure and function—Penicillium, Agaricus, Ulva, Laminaria, and Nitella; and, as a parallel to these in the animal series, we have two chapters, with excellent woodcuts, on Hydra and on the Hydroid polyps, their colony-building and their alternation of generations. The extremely important facts and theories of spermatogenesis and oogenesis and of fertilization are next set forth, briefly but clearly, and in sufficient detail for the general purposes of the book. In connection with the early development of the fertilized egg-cell of the Metazoon from its unicellular phase to the condition of the diblastula, the question is considered as to how we are to suppose that the passage took place historically from Protozoa to Metazoa or Enterozoa. It is pointed out that there is a break here in the series of living animals known to us, whilst there is no corresponding break in the series of plants: there we pass by insensible gradations from unicellular forms to linear aggregates of cells, and from these to superficial and to solid aggregates.

The *Magosphæra planula* described by Haeckel in 1870 is cited as an animal tending to bridge over the gap in the animal series, but a footnote informs the reader that "unfortunately nobody has since seen this organism." Prof. Parker probably is aware that this is also true of Haeckel's *Protomyxa aurantiaca*, which he figures and describes in an earlier chapter. It certainly is to be regretted that neither of these interesting organisms has been observed again since they were described by Haeckel. However, *Volvox globator* is always with us, and Prof. Parker gives an excellent set of figures and a description of it, and proceeds to show how a two-cell-layered sac—the ancestral gastrula or diblastula—might have been derived from such a colony. He also shows how a primitive diploblastic form might have developed from a multi-nucleate Protozoon, such as Opalina or Oxytricha.

In the laboratory it is convenient to take the Earthworm as an example of that central type of structure which is found under various modifications in all the Cœlomate animals. Prof. Parker, rightly separating himself from the ties of laboratory work, prefers the marine worm Polygordius for his illustration of this grade of structure, choosing it partly on account of its greater simplicity, partly on account of its extremely interesting and well-studied developmental history. As the author contends, a student who reads the two chapters here devoted to the anatomy, physiology, and development of Polygordius, will have an immense advantage either in his subsequent study of the Earthworm, or in reverting to his notes of a previous dissection of that worthy beast. The principle of the comparative method will be revealed to him, and he will learn to distinguish things essential from things non-essential.

Next, with a rush, having scaled the long ladder leading to Polygordius, Prof. Parker takes his reader in one chapter of seventeen pages through the anatomy and morphology of the starfish, the crayfish, the mussel, and the dogfish. This seems and is rather rapid, but the rapidity is intentional and justifiable. By the aid of *this* book the student is intended only to gain a general view of the structure of those animals as comparable to that of Polygordius. For further details he must go on to the special study of animal morphology, physiology, and embryology; or having studied these subjects more or less, he may, by aid of Prof. Parker's clever schematic woodcuts, gain a vivid impression of the unity of organization and the divergence in minor points of structure of the higher animals when compared one with another. Perhaps, however, in that enlarged edition of this book which will at no distant date appear, Prof. Parker will treat the higher animals less unceremoniously; this he might do, and yet retain that conciseness and regard for the essential which form an admirable characteristic of his method.

Mosses and Ferns are treated as the parallel among plants of Polygordius in the animal series; and in a single chapter Equisetum, Salvinia, Selaginella, Gymnosperms, and Angiosperms are surveyed (and excellently illustrated by finished woodcuts) in such a way as to give the student an accurate and highly effective survey of the great features of vegetable morphology and physiology.

Such is the outline of these "Lessons." Their merit, however, consists not merely in the general plan, but in the fact that the author is an experienced teacher and an accomplished investigator, who has developed to a high degree the art of lucid statement—one who is thoroughly familiar with the latest researches in the wide field of which he treats, and is able, whilst setting before his reader the most important generalizations of his science, to avoid redundancy, and to give a fresh and original handling to the oft-told story of the structure and functions of living things.

E. Ray Lankester.

CEREBRAL LOCALIZATION.

The Croonian Lectures on Cerebral Localization. By David Ferrier, M.D., LL.D., F.R.S., &c. With Illustrations. (London: Smith, Elder, and Co., 1890.)

In these valuable lectures, Dr. Ferrier reviews the subject of cerebral localization, so far as the representation of movement and of special sense is concerned. After referring categorically, in the first of the series, to the historical experiments on the subject, arranged in order of chronological sequence, he points out the fundamental principles embodied in the term cerebral localization. Leaving the discussion of motor representation, he devotes the remaining five lectures to the consideration of the cortical representation of the special senses, beginning with that of sight.

The representation of sight is, according to all observers, mainly restricted to a definite area of the cortex. The differentiation of that area and its topographical subdivision are points of the highest interest, and naturally do not escape discussion. We are rather surprised, however, to find that Dr. Ferrier is not prepared to admit that Munk and Schäfer's experiments, besides those of other observers, establish visual representation to be situated in the occipital lobe, but is inclined to believe that the angular gyrus is the centre for clear vision mainly for the eye of the opposite side. Upon this we would only remark that it does not appear to us that the mass of evidence relating to crossed hemianopsia, whether of experimental or clinical nature, can be put aside as easily as Dr. Ferrier would seem to consider possible, but those interested in the subject will find many of the facts bearing on this question referred to in his treatment of the points at issue.

So, too, with the representation of audition, while all (save Schäfer's and Sanger Brown's) observations support Dr. Ferrier's views of the seat of representation of hearing, it would undoubtedly have been better that the rebutting evidence brought against the exceptional facts referred to should have consisted of a number of experiments, and not of a single one, even although that seems to have been a very conclusive observation.

After disposing of the centre of audition, the tactile centre receives attention, and is preceded by a discussion of the paths along which afferent impressions travel in the spinal cord to the higher centres. Of course, this subject has been very actively investigated by various observers for many years, but it has always appeared to us that sufficient attention has never been given to the simple consideration whether or not the *lower* centres are engaged in the transmission of such impulses. In the limited space at Dr. Ferrier's disposal he has evidently not been able to give this matter full discussion, and is therefore led to assume that Brown Séquard's dictum respecting the passage of afferent (tactile, not painful) impulses up the opposite side of the cord holds good. This question is now being reinvestigated, and the preliminary observations published by Mott and others throw very grave doubt on the validity of this assumption, which has so long been accepted as final.

As regards the representation of common tactile sensation in the cortex cerebri, Dr. Ferrier discovered that it was probably represented in the hippocampal region, and he reviews the results of his experiments, as well as those of Schäfer and Horsley, which tended to show that the gyrus fornicatus, as well as the hippocampus, were the seat of tactile perception, and he concludes that possibly the whole limbic lobe is concerned with this representation.

As regards, however, the representation of sensation in the excitable or motor part of the cortex, he will "have none of it." Here, again, we are afraid that the considerations of time and space, which always handicap subjects treated in lecture form, account for the fact that the critical examination of this question is not so complete as perhaps it might have been made.

On the whole, these lectures well maintain the author's high reputation as a keen observer, and an indefatigable student, gifted with singular clearness and distinctness of expression, and they will well repay perusal by all who wish to follow the progress of knowledge of cerebral localization and its most important bearings.

OUR BOOK SHELF.

Education and Heredity. By J. M. Guyau. (London: Walter Scott, 1891.)

This small and excellently-translated work is a posthumous publication, written by a Frenchman who died four years ago at the early age of thirty-three. He was a fluent and prolific writer, the author of no less than fourteen other publications, and is described in the introduction as a philosopher and poet. It would seem from this book that the latter temperament was his prevalent characteristic. Its prevalent literary style and the originality both of metaphor and of handling will commend itself, and so will the account of recent hypnotic in-